

NODE=B062

N(1520) 3/2⁻ $I(J^P) = \frac{1}{2}(\frac{3}{2}^-)$ Status: ***

Most of the results published before 1975 were last included in our 1982 edition, Physics Letters **111B** 1 (1982). Some further obsolete results published before 1984 were last included in our 2006 edition, Journal of Physics, G **33** 1 (2006).

NODE=B062

N(1520) BREIT-WIGNER MASS

NODE=B062M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1515 to 1525 (\approx 1520) OUR ESTIMATE			
1517 \pm 3	ANISOVICH	12A	DPWA Multichannel
1514.5 \pm 0.2	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
1525 \pm 10	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
1519 \pm 4	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1512.6 \pm 0.5	SHRESTHA	12A	DPWA Multichannel
1524 \pm 4	ANISOVICH	10	DPWA Multichannel
1522 \pm 8	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
1520 \pm 10	THOMA	08	DPWA Multichannel
1516.3 \pm 0.8	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
1509 \pm 1	PENNER	02C	DPWA Multichannel
1518 \pm 3	VRANA	00	DPWA Multichannel
1516 \pm 10	ARNDT	96	IPWA $\gamma N \rightarrow \pi N$
1515	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
1510	LI	93	IPWA $\gamma N \rightarrow \pi N$
1524 \pm 4	MANLEY	92	IPWA $\pi N \rightarrow \pi N & N\pi\pi$
1510	¹ LONGACRE	77	IPWA $\pi N \rightarrow N\pi\pi$
1520	² LONGACRE	75	IPWA $\pi N \rightarrow N\pi\pi$

***N(1520) BREIT-WIGNER WIDTH***

NODE=B062W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
100 to 125 (\approx 115) OUR ESTIMATE			
114 \pm 5	ANISOVICH	12A	DPWA Multichannel
103.6 \pm 0.4	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
120 \pm 15	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
114 \pm 7	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
117 \pm 1	SHRESTHA	12A	DPWA Multichannel
117 \pm 6	ANISOVICH	10	DPWA Multichannel
132 \pm 11	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
125 \pm 15	THOMA	08	DPWA Multichannel
98.6 \pm 2.6	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
100 \pm 2	PENNER	02C	DPWA Multichannel
124 \pm 4	VRANA	00	DPWA Multichannel
106 \pm 4	ARNDT	96	IPWA $\gamma N \rightarrow \pi N$
106	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
120	LI	93	IPWA $\gamma N \rightarrow \pi N$
124 \pm 8	MANLEY	92	IPWA $\pi N \rightarrow \pi N & N\pi\pi$
110	¹ LONGACRE	77	IPWA $\pi N \rightarrow N\pi\pi$
150	² LONGACRE	75	IPWA $\pi N \rightarrow N\pi\pi$

***N(1520) POLE POSITION***

NODE=B062215

REAL PART VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1505 to 1515 (\approx 1510) OUR ESTIMATE			
1507 \pm 3	ANISOVICH	12A	DPWA Multichannel
1515	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
1510	³ HOEHLER	93	ARGD $\pi N \rightarrow \pi N$
1510 \pm 5	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$

NODE=B062RE

NODE=B062RE

→ UNCHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

1501	SHRESTHA	12A	DPWA	Multichannel
1512±3	ANISOVICH	10	DPWA	Multichannel
1506±9	BATINIC	10	DPWA	$\pi N \rightarrow N\pi, N\eta$
1509±7	THOMA	08	DPWA	Multichannel
1514	ARNDT	04	DPWA	$\pi N \rightarrow \pi N, \eta N$
1504	VRANA	00	DPWA	Multichannel
1515	ARNDT	95	DPWA	$\pi N \rightarrow N\pi$
1511	ARNDT	91	DPWA	$\pi N \rightarrow \pi N$ Soln SM90
1514 or 1511	⁴ LONGACRE	78	IPWA	$\pi N \rightarrow N\pi\pi$
1508 or 1505	¹ LONGACRE	77	IPWA	$\pi N \rightarrow N\pi\pi$

-2xIMAGINARY PART

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
105 to 120 (≈ 110) OUR ESTIMATE			

111± 5	ANISOVICH	12A	DPWA	Multichannel
113	ARNDT	06	DPWA	$\pi N \rightarrow \pi N, \eta N$
120	³ HOEHLER	93	ARGD	$\pi N \rightarrow \pi N$
114±10	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
112	SHRESTHA	12A	DPWA	Multichannel
110± 6	ANISOVICH	10	DPWA	Multichannel
122± 9	BATINIC	10	DPWA	$\pi N \rightarrow N\pi, N\eta$
113±12	THOMA	08	DPWA	Multichannel
102	ARNDT	04	DPWA	$\pi N \rightarrow \pi N, \eta N$
112	VRANA	00	DPWA	Multichannel
110	ARNDT	95	DPWA	$\pi N \rightarrow N\pi$
108	ARNDT	91	DPWA	$\pi N \rightarrow \pi N$ Soln SM90
146 or 137	⁴ LONGACRE	78	IPWA	$\pi N \rightarrow N\pi\pi$
109 or 107	¹ LONGACRE	77	IPWA	$\pi N \rightarrow N\pi\pi$

N(1520) ELASTIC POLE RESIDUE

MODULUS |r|

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
35±3 OUR ESTIMATE				
36±3	ANISOVICH	12A	DPWA Multichannel	
38	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$	
32	HOEHLER	93	ARGD $\pi N \rightarrow \pi N$	
35±2	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
35	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$	
35	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$	
34	ARNDT	95	DPWA $\pi N \rightarrow N\pi$	
33	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90	

NODE=B062IM

NODE=B062IM

→ UNCHECKED ←

PHASE θ

VALUE (°)	DOCUMENT ID	TECN	COMMENT	
-10±5 OUR ESTIMATE				
-14±3	ANISOVICH	12A	DPWA Multichannel	
- 5	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$	
- 8	HOEHLER	93	ARGD $\pi N \rightarrow \pi N$	
-12±5	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
- 7	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$	
- 6	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$	
7	ARNDT	95	DPWA $\pi N \rightarrow N\pi$	
-10	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90	

NODE=B062IMR

NODE=B062IMR

→ UNCHECKED ←

N(1520) INELASTIC POLE RESIDUE

The "normalized residue" is the residue divided by $\Gamma_{pole}/2$.

Normalized residue in $N\pi \rightarrow N(1520) \rightarrow \Delta\pi, S\text{-wave}$

MODULUS (%)	PHASE (°)	DOCUMENT ID	TECN	COMMENT
33±5	150 ± 20	ANISOVICH	12A	DPWA Multichannel

NODE=B062240

NODE=B062240

NODE=B062RS1

NODE=B062RS1

Normalized residue in $N\pi \rightarrow N(1520) \rightarrow \Delta\pi, D\text{-wave}$

<u>MODULUS (%)</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
25±3	100 ± 20	ANISOVICH	12A	DPWA Multichannel

 $N(1520)$ DECAY MODES

The following branching fractions are our estimates, not fits or averages.

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 N\pi$	55–65 %
$\Gamma_2 N\eta$	$(2.3 \pm 0.4) \times 10^{-3}$
$\Gamma_3 N\pi\pi$	20–30 %
$\Gamma_4 \Delta\pi$	15–25 %
$\Gamma_5 \Delta(1232)\pi, S\text{-wave}$	10–20 %
$\Gamma_6 \Delta(1232)\pi, D\text{-wave}$	10–15 %
$\Gamma_7 N\rho$	15–25 %
$\Gamma_8 N\rho, S=3/2, S\text{-wave}$	$(9.0 \pm 1.0) \%$
$\Gamma_9 N(\pi\pi)_{S\text{-wave}}^{I=0}$	<8 %
$\Gamma_{10} p\gamma$	0.31–0.52 %
$\Gamma_{11} p\gamma, \text{ helicity}=1/2$	0.01–0.02 %
$\Gamma_{12} p\gamma, \text{ helicity}=3/2$	0.30–0.50 %
$\Gamma_{13} n\gamma$	0.30–0.53 %
$\Gamma_{14} n\gamma, \text{ helicity}=1/2$	0.04–0.10 %
$\Gamma_{15} n\gamma, \text{ helicity}=3/2$	0.25–0.45 %

 $N(1520)$ BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{\text{total}}$	Γ_1/Γ
<u>VALUE (%)</u>	
55 to 65 OUR ESTIMATE	
62 ± 3	ANISOVICH 12A DPWA Multichannel
63.2 ± 0.1	ARNDT 06 DPWA $\pi N \rightarrow \pi N, \eta N$
58 ± 3	CUTKOSKY 80 IPWA $\pi N \rightarrow \pi N$
54 ± 3	HOEHLER 79 IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •	
62.7 ± 0.5	SHRESTHA 12A DPWA Multichannel
57 ± 5	ANISOVICH 10 DPWA Multichannel
55 ± 5	BATINIC 10 DPWA $\pi N \rightarrow N\pi, N\eta$
58 ± 8	THOMA 08 DPWA Multichannel
64.0 ± 0.5	ARNDT 04 DPWA $\pi N \rightarrow \pi N, \eta N$
56 ± 1	PENNER 02C DPWA Multichannel
63 ± 2	VRANA 00 DPWA Multichannel
61	ARNDT 95 DPWA $\pi N \rightarrow N\pi$
59 ± 3	MANLEY 92 IPWA $\pi N \rightarrow \pi N \& N\pi\pi$

$\Gamma(N\eta)/\Gamma_{\text{total}}$	Γ_2/Γ
<u>VALUE (%)</u>	
0.23 ± 0.04 OUR AVERAGE	
0.23 ± 0.04	PENNER 02C DPWA Multichannel
0 ± 1	VRANA 00 DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •	
0.1 ± 0.1	BATINIC 10 DPWA $\pi N \rightarrow N\pi, N\eta$
0.2 ± 0.1	THOMA 08 DPWA Multichannel
0.08 to 0.12	ARNDT 05 DPWA Multichannel
0.08 ± 0.01	TIATOR 99 DPWA $\gamma p \rightarrow p\eta$

Note: Signs of couplings from $\pi N \rightarrow N\pi\pi$ analyses were changed in the 1986 edition to agree with the baryon-first convention; the overall phase ambiguity is resolved by choosing a negative sign for the $\Delta(1620) S_{31}$ coupling to $\Delta(1232)\pi$.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow N(1520) \rightarrow \Delta(1232)\pi, S\text{-wave}$	$(\Gamma_1\Gamma_5)^{1/2}/\Gamma$
<u>VALUE</u>	<u>DOCUMENT ID</u>
-0.26 to -0.20 OUR ESTIMATE	
-0.26	1,5 LONGACRE 77 IPWA $\pi N \rightarrow N\pi\pi$
-0.24	2 LONGACRE 75 IPWA $\pi N \rightarrow N\pi\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •	
-0.18 ± 0.05	MANLEY 92 IPWA $\pi N \rightarrow \pi N \& N\pi\pi$

NODE=B062RS2
NODE=B062RS2

NODE=B062225; NODE=B062

NODE=B062

DESIG=1;OUR EST
DESIG=2
DESIG=4;OUR EST
DESIG=181;OUR EST
DESIG=5;OUR EST
DESIG=6;OUR EST
DESIG=182;OUR EST
DESIG=8
DESIG=10;OUR EST
DESIG=184;OUR EST
DESIG=11;OUR EST
DESIG=12;OUR EST
DESIG=185;OUR EST
DESIG=13;OUR EST
DESIG=14;OUR EST

NODE=B062230

NODE=B062R1
NODE=B062R1
→ UNCHECKED ←

NODE=B062R7
NODE=B062R7

NODE=B062310

NODE=B062R3
NODE=B062R3
→ UNCHECKED ←

$\Gamma(\Delta(1232)\pi, S\text{-wave})/\Gamma_{\text{total}}$

VALUE (%)

10 to 20 OUR ESTIMATE

19 \pm 4	ANISOVICH	12A	DPWA	Multichannel
15 \pm 2	VRANA	00	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
9.3 \pm 0.7	SHRESTHA	12A	DPWA	Multichannel
12 \pm 4	THOMA	08	DPWA	Multichannel

 Γ_5/Γ

NODE=B062R10
 NODE=B062R10
 → UNCHECKED ←

 $(\Gamma_i \Gamma_f)^{1/2}/\Gamma_{\text{total}} \text{ in } N\pi \rightarrow N(1520) \rightarrow \Delta(1232)\pi, D\text{-wave}$

VALUE

-0.28 to -0.24 OUR ESTIMATE

DOCUMENT ID	TECN	COMMENT		
1, ⁵ LONGACRE	77	IPWA $\pi N \rightarrow N\pi\pi$		
2 LONGACRE	75	IPWA $\pi N \rightarrow N\pi\pi$		
• • • We do not use the following data for averages, fits, limits, etc. • • •				
MANLEY	92	IPWA $\pi N \rightarrow \pi N \& N\pi\pi$		

 $(\Gamma_1 \Gamma_6)^{1/2}/\Gamma$

NODE=B062R4
 NODE=B062R4
 → UNCHECKED ←

 $\Gamma(\Delta(1232)\pi, D\text{-wave})/\Gamma_{\text{total}}$

VALUE (%)

10 to 15 OUR ESTIMATE

9 \pm 2	ANISOVICH	12A	DPWA	Multichannel
11 \pm 2	VRANA	00	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
6.3 \pm 0.5	SHRESTHA	12A	DPWA	Multichannel
14 \pm 5	THOMA	08	DPWA	Multichannel

 Γ_6/Γ

NODE=B062R9
 NODE=B062R9
 → UNCHECKED ←

 $(\Gamma_i \Gamma_f)^{1/2}/\Gamma_{\text{total}} \text{ in } N\pi \rightarrow N(1520) \rightarrow N\rho, S=3/2, S\text{-wave}$

VALUE

-0.35 to -0.31 OUR ESTIMATE

DOCUMENT ID	TECN	COMMENT		
1, ⁵ LONGACRE	77	IPWA $\pi N \rightarrow N\pi\pi$		
2 LONGACRE	75	IPWA $\pi N \rightarrow N\pi\pi$		
• • • We do not use the following data for averages, fits, limits, etc. • • •				
MANLEY	92	IPWA $\pi N \rightarrow \pi N \& N\pi\pi$		

 $(\Gamma_1 \Gamma_8)^{1/2}/\Gamma$

NODE=B062R5
 NODE=B062R5
 → UNCHECKED ←

 $\Gamma(N\rho, S=3/2, S\text{-wave})/\Gamma_{\text{total}}$

VALUE (%)

9 \pm 1

DOCUMENT ID	TECN	COMMENT		
VRANA	00	DPWA Multichannel		
• • • We do not use the following data for averages, fits, limits, etc. • • •				
20.9 \pm 0.7	SHRESTHA	12A DPWA Multichannel		

 Γ_8/Γ

NODE=B062R8
 NODE=B062R8

 $(\Gamma_i \Gamma_f)^{1/2}/\Gamma_{\text{total}} \text{ in } N\pi \rightarrow N(1520) \rightarrow N(\pi\pi)_{S\text{-wave}}^{I=0}$

VALUE

-0.22 to -0.06 OUR ESTIMATE

DOCUMENT ID	TECN	COMMENT
1, ⁵ LONGACRE	77	IPWA $\pi N \rightarrow N\pi\pi$
2 LONGACRE	75	IPWA $\pi N \rightarrow N\pi\pi$

 $(\Gamma_1 \Gamma_9)^{1/2}/\Gamma$

NODE=B062R6
 NODE=B062R6
 → UNCHECKED ←

 $\Gamma(N(\pi\pi)_{S\text{-wave}}^{I=0})/\Gamma_{\text{total}}$

VALUE (%)

1 \pm 1

DOCUMENT ID	TECN	COMMENT		
VRANA	00	DPWA Multichannel		
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1	SHRESTHA	12A DPWA Multichannel		
<4	THOMA	08 DPWA Multichannel		

 Γ_9/Γ

NODE=B062R11
 NODE=B062R11

N(1520) PHOTON DECAY AMPLITUDES

Papers on γN amplitudes predating 1981 may be found in our 2006 edition, Journal of Physics, G **33** 1 (2006).

N(1520) $\rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$ VALUE (GeV $^{-1/2}$)**-0.024 \pm 0.009 OUR ESTIMATE**

DOCUMENT ID	TECN	COMMENT
ANISOVICH	12A	DPWA Multichannel
WORKMAN	12A	DPWA $\gamma N \rightarrow N\pi$
DUGGER	07	DPWA $\gamma N \rightarrow \pi N$
AHRENS	02	DPWA $\gamma N \rightarrow \pi N$
CRAWFORD	83	IPWA $\gamma N \rightarrow \pi N$
AWAJI	81	DPWA $\gamma N \rightarrow \pi N$

NODE=B062235

NODE=B062235

NODE=B062A1

NODE=B062A1

→ UNCHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

-0.034±0.001	SHRESTHA	12A	DPWA	Multichannel
-0.032±0.006	ANISOVICH	10	DPWA	Multichannel
-0.027	DRECHSEL	07	DPWA	$\gamma N \rightarrow \pi N$
-0.003	PENNER	02D	DPWA	Multichannel
-0.052±0.010±0.007	6 MUKHOPAD...	98		$\gamma p \rightarrow \eta p$
-0.020±0.007	ARNDT	96	IPWA	$\gamma N \rightarrow \pi N$
-0.020±0.002	LI	93	IPWA	$\gamma N \rightarrow \pi N$
-0.012	WADA	84	DPWA	Compton scattering

$N(1520) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE (GeV ^{-1/2})	DOCUMENT ID	TECN	COMMENT	
0.150±0.015 OUR ESTIMATE				NODE=B062A2 NODE=B062A2 → UNCHECKED ←
0.131±0.010	ANISOVICH	12A	DPWA	Multichannel
0.141±0.002	WORKMAN	12A	DPWA	$\gamma N \rightarrow N\pi$
0.143±0.002	DUGGER	07	DPWA	$\gamma N \rightarrow \pi N$
0.147±0.010	AHRENS	02	DPWA	$\gamma N \rightarrow \pi N$
0.156±0.022	CRAWFORD	83	IPWA	$\gamma N \rightarrow \pi N$
0.168±0.013	AWAJI	81	DPWA	$\gamma N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.127±0.003	SHRESTHA	12A	DPWA	Multichannel
0.138±0.008	ANISOVICH	10	DPWA	Multichannel
0.161	DRECHSEL	07	DPWA	$\gamma N \rightarrow \pi N$
0.151	PENNER	02D	DPWA	Multichannel
0.130±0.020±0.015	6 MUKHOPAD...	98		$\gamma p \rightarrow \eta p$
0.167±0.005	ARNDT	96	IPWA	$\gamma N \rightarrow \pi N$
0.167±0.002	LI	93	IPWA	$\gamma N \rightarrow \pi N$
0.168	WADA	84	DPWA	Compton scattering

$N(1520) \rightarrow n\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE (GeV ^{-1/2})	DOCUMENT ID	TECN	COMMENT	
-0.059±0.009 OUR ESTIMATE				NODE=B062A3 NODE=B062A3 → UNCHECKED ←
-0.046±0.006	CHEN	12A	DPWA	$\gamma N \rightarrow \pi N$
-0.066±0.013	AWAJI	81	DPWA	$\gamma N \rightarrow \pi N$
-0.067±0.004	FUJII	81	DPWA	$\gamma N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-0.038±0.003	SHRESTHA	12A	DPWA	Multichannel
-0.077	DRECHSEL	07	DPWA	$\gamma N \rightarrow \pi N$
-0.084	PENNER	02D	DPWA	Multichannel
-0.048±0.008	ARNDT	96	IPWA	$\gamma N \rightarrow \pi N$
-0.058±0.003	LI	93	IPWA	$\gamma N \rightarrow \pi N$

$N(1520) \rightarrow n\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE (GeV ^{-1/2})	DOCUMENT ID	TECN	COMMENT	
-0.139±0.011 OUR ESTIMATE				NODE=B062A4 NODE=B062A4 → UNCHECKED ←
-0.115±0.005	CHEN	12A	DPWA	$\gamma N \rightarrow \pi N$
-0.124±0.009	AWAJI	81	DPWA	$\gamma N \rightarrow \pi N$
-0.158±0.003	FUJII	81	DPWA	$\gamma N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-0.101±0.004	SHRESTHA	12A	DPWA	Multichannel
-0.154	DRECHSEL	07	DPWA	$\gamma N \rightarrow \pi N$
-0.159	PENNER	02D	DPWA	Multichannel
-0.140±0.010	ARNDT	96	IPWA	$\gamma N \rightarrow \pi N$
-0.131±0.003	LI	93	IPWA	$\gamma N \rightarrow \pi N$

$N(1520)$ FOOTNOTES

¹ LONGACRE 77 pole positions are from a search for poles in the unitarized T-matrix; the first (second) value uses, in addition to $\pi N \rightarrow N\pi\pi$ data, elastic amplitudes from a Saclay (CERN) partial-wave analysis. The other LONGACRE 77 values are from eyeball fits with Breit-Wigner circles to the T-matrix amplitudes.

² From method II of LONGACRE 75: eyeball fits with Breit-Wigner circles to the T-matrix amplitudes.

³ See HOEHLER 93 for a detailed discussion of the evidence for and the pole parameters of N and Δ resonances as determined from Argand diagrams of πN elastic partial-wave amplitudes and from plots of the speeds with which the amplitudes traverse the diagrams.

⁴ LONGACRE 78 values are from a search for poles in the unitarized T-matrix. The first (second) value uses, in addition to $\pi N \rightarrow N\pi\pi$ data, elastic amplitudes from a Saclay (CERN) partial-wave analysis.

NODE=B062

NODE=B062;LINKAGE=L7

NODE=B062;LINKAGE=L5

NODE=B010;LINKAGE=H9

NODE=B062;LINKAGE=L8

5 LONGACRE 77 considers this coupling to be well determined.

6 MUKHOPADHYAY 98 uses an effective Lagrangian approach to analyze η photoproduction data. The ratio of the $A_{3/2}$ and $A_{1/2}$ amplitudes is determined, with less model dependence than the amplitudes themselves, to be $A_{3/2}/A_{1/2} = -2.5 \pm 0.5 \pm 0.4$.

N(1520) REFERENCES

For early references, see Physics Letters **111B** 1 (1982). For very early references, see Reviews of Modern Physics **37** 633 (1965).

ANISOVICH	12A	EPJ A48 15	A.V. Anisovich <i>et al.</i>	(BONN, PNPI)	REFID=54041
CHEN	12A	PR C86 015206	W. Chen <i>et al.</i>	(DUKE, GWU, MSST, ITEP+)	REFID=54337
SHRESTHA	12A	PR C86 055203	M. Shrestha, D.M. Manley	(KSU)	REFID=54862
WORKMAN	12A	PR C86 015202	R. Workman <i>et al.</i>	(GWU)	REFID=54335
ANISOVICH	10	EPJ A44 203	A.V. Anisovich <i>et al.</i>	(BONN, PNPI)	REFID=53280
BATINIC	10	PR C82 038203	M. Batinic <i>et al.</i>	(ZAGR)	REFID=53552
THOMA	08	PL B659 87	U. Thoma <i>et al.</i>	(CB-ELSA Collab.)	REFID=52087
DRECHSEL	07	EPJ A34 69	D. Drechsel, S.S. Kamalov, L. Tiator	(MAINZ, JINR)	REFID=52105
DUGGER	07	PR C76 025211	M. Dugger <i>et al.</i>	(Jefferson Lab CLAS Collab.)	REFID=52039
ARNDT	06	PR C74 045205	R.A. Arndt <i>et al.</i>	(GWU)	REFID=51535
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
ARNDT	05	PR C72 045202	R.A. Arndt <i>et al.</i>	(GWU, PNPI)	REFID=50856
ARNDT	04	PR C69 035213	R.A. Arndt <i>et al.</i>	(GWU, TRIU)	REFID=49947
AHRENS	02	PRL 88 232002	J. Ahrens <i>et al.</i>	(Mainz MAMI GDH/A2 Collab.)	REFID=48710
PENNER	02C	PR C66 055211	G. Penner, U. Mosel	(GIES)	REFID=49129
PENNER	02D	PR C66 055212	G. Penner, U. Mosel	(GIES)	REFID=49130
VRANA	00	PRPL 328 181	T.P. Vrana, S.A. Dytman., T.-S.H. Lee	(PITT+)	REFID=47593
TIATOR	99	PR C60 035210	L. Tiator <i>et al.</i>		REFID=47238
MUKHOPAD... ...Y	98	PL B444 7	N.C. Mukhopadhyay, N. Mathur		REFID=46538
ARNDT	96	PR C53 430	R.A. Arndt, I.I. Strakovsky, R.L. Workman	(VPI)	REFID=44675
ARNDT	95	PR C52 2120	R.A. Arndt <i>et al.</i>	(VPI, BRCO)	REFID=44535
HOEHLER	93	πN Newsletter 9 1	G. Hohler	(KARL)	REFID=43821
LI	93	PR C47 2759	Z.J. Li <i>et al.</i>	(VPI)	REFID=43327
MANLEY	92	PR D45 4002	D.M. Manley, E.M. Saleski	(KSA) IJP	REFID=41535
Also		PR D30 904	D.M. Manley <i>et al.</i>	(VPI)	REFID=30071
ARNDT	91	PR D43 2131	R.A. Arndt <i>et al.</i>	(VPI, TELE) IJP	REFID=41467
WADA	84	NP B247 313	Y. Wada <i>et al.</i>	(INUS)	REFID=30072
CRAWFORD	83	NP B211 1	R.L. Crawford, W.T. Morton	(GLAS)	REFID=30070
PDG	82	PL 111B 1	M. Roos <i>et al.</i>	(HELS, CIT, CERN)	REFID=41167
AWAJI	81	Bonn Conf. 352	N. Awaji, R. Kajikawa	(NAGO)	REFID=30067
Also		NP B197 365	K. Fujii <i>et al.</i>	(NAGO)	REFID=30068
FUJII	81	NP B187 53	K. Fujii <i>et al.</i>	(NAGO, OSAK)	REFID=30069
CUTKOSKY	80	Toronto Conf. 19	R.E. Cutkosky <i>et al.</i>	(CMU, LBL) IJP	REFID=30064
Also		PR D20 2839	R.E. Cutkosky <i>et al.</i>	(CMU, LBL) IJP	REFID=40096
HOEHLER	79	PDAT 12-1	G. Hohler <i>et al.</i>	(KARLT) IJP	REFID=30058
Also		Toronto Conf. 3	R. Koch	(KARLT) IJP	REFID=30859
LONGACRE	78	PR D17 1795	R.S. Longacre <i>et al.</i>	(LBL, SLAC)	REFID=30054
LONGACRE	77	NP B122 493	R.S. Longacre, J. Dolbeau	(SACL) IJP	REFID=30051
Also		NP B108 365	J. Dolbeau <i>et al.</i>	(SACL) IJP	REFID=30052
LONGACRE	75	PL 55B 415	R.S. Longacre <i>et al.</i>	(LBL, SLAC) IJP	REFID=30047

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